

Analysis of Intermediate Chinese Learners' Persistent Errors in the Production of Tone 2 in Mandarin Chinese*

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Abstract

This study examines the persistent errors of intermediate-level Chinese language learners in the production of Tone 2. Four Chinese native speakers' production of Tone 2 in isolation and in each of its possible tone combinations in bi-syllabic words serves as a point of comparison for the analysis of the production of the same tokens of Tone 2 by four intermediate-level learners of Chinese. The analysis specifically focuses on comparing the pitch contour of non-native speakers with native speakers of Mandarin. Different pitch contours for non-native speaker production of Tone 2 are identified and evaluated. The results of this study challenge teachers and textbook writers to re-consider how tones are visually represented to students and suggest pedagogical interventions for intermediate-level students with persistent Tone 2 errors.

Key words

Tone 2, pitch contour, native speaker production, non-native speaker production

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1. Introduction

Attaining native-like accuracy in producing the rising tone (Tone 2) in Mandarin appears to present difficulty for many Chinese language learners (Hao 2012:277). This study examines the persistent errors of intermediate-level Chinese language learners in the production of Tone 2 by comparing non-native and native speaker production of Tone 2 in isolation and in each of its possible tone combinations in bi-syllabic words. The purpose of the study is to identify, categorize, and describe common errors in the production of Tone 2 which persist into the intermediate level and to suggest how Tone 2 instruction could be improved to address these problems. A secondary purpose of this study is to develop a research method for analyzing tone errors which could be applied to a larger scale analysis of all four citation tones.

2. Design of the study

In terms of data collection and analysis, our approach was to first analyze how four Chinese native speakers produce Tone 2 in isolation and in each of its possible tone combinations in bi-syllabic words. These results then served as a point of comparison for the analysis of the production of Tone 2 by four intermediate-level learners of Chinese. The analysis specifically focused on comparing the pitch contour of four non-native speakers with four native speakers of Mandarin.

2.1 Elicitation tokens

Both native and non-native speaking participants were asked to produce the same set of Chinese tokens in the same Chinese carrier sentence. The prompts for all participants showed the target words in characters and *pinyin* side-by-side on a PowerPoint slide underneath the carrier sentence which was displayed in Chinese characters only. The reason for presenting the target words in both Chinese characters and *pinyin* was to ensure that all participants were thinking about the same citation tone and to lessen the degree to which tone differences produced by non-native speakers could be attributed to a tone memory error. Since the tonal characteristics of the words in the carrier sentence were not of major consequence for the purposes of this study, the carrier sentence was displayed in Chinese characters only, but a native speaker produced the carrier sentence for the non-native speakers prior to beginning the elicitation task to ensure that they all felt comfortable producing it. The carrier sentence used was 他说了____. ‘He said ____.’ This sentence was chosen because the word preceding the elicitation target ends with the mid vowel [ə] produced in a neutral tone and thus was deemed less likely to influence the pitch or tone of the succeeding word. Since the use of a carrier sentence served to control the timing of the production of the target word, the participants were allowed to advance the PowerPoint presentation at their own discretion. Table 1 below shows the elicitation tokens that were selected for this study. All the tokens were selected from vocabulary items in a beginning-level Chinese textbook and were therefore familiar to intermediate-level Chinese language learners.

Table 1: Elicitation targets for the production of Tone 2 in Mandarin

Tonal Context	IPA	Chinese	Pinyin	English
T2	[ɿən] ₃₅	人	rén	‘person’
T2 + T1	[jɛn] ₃₅ [tɕjou] ₅₅	研究	yánjiū	‘research’
T1 + T2	[tʂuŋ] ₅₅ [kwo] ₃₅	中国	Zhōngguó	‘China’
T2 + T2	[wu] ₃₅ [nəŋ] ₃₅	无能	wúnéng	‘incompetent’

T2 + T3	[njou] ₃₅ [nai] ₂₁₄	牛奶	niúnǎi	‘milk’
T3 + T2	[mei] ₂₁ [kwo] ₃₅	美国	Měiguó	‘America’
T2 + T4	[jou] ₃₅ [p ^h ɿau] ₅₁	邮票	yóupiào	‘postage stamp’
T4 + T2	[ta] ₅₁ [ɕue] ₃₅	大学	dàxué	‘university’
T2 + neutral	[mjəŋ] ₃₅ [tsɿ] ₂	名字	míngzi	‘name’

2.2 Participants

This study analyzes data collected from four native speakers of Mandarin Chinese and four intermediate-level learners of Chinese as a foreign language. To obtain a sample that demonstrates some of the range that can exist in native speaker production of Tone 2, the native speaker (NS) participants included one male and one female native speaker from northern China and one male and one female native speaker from southern China, ranging in age from 28 to 36. In addition to being native speakers of Mandarin, the two southern Chinese participants were also speakers of Cantonese and the two northern Chinese participants were speakers of a local dialect of Shandong province.

The four non-native speakers (NNS) were all students in their second semester of intermediate Chinese instruction at a large, public university in the US. There were two male and two female participants ranging in age from 20 to 29. These intermediate-level students were chosen in order to focus on tone errors that persist after students have a well-established framework for the production of the four citation tones. All students were considered by the teacher to be high-performing, yet as this study found the students were still plagued by persistent errors in the production of Tone 2.

2.3 Data collection and method of analysis

The four native speakers recruited for this study were asked to read the nine sentences with the elicitation tokens inserted in sentence-final position. The audio recording of the sentences was conducted on Praat version 6.0.12 using a Macbook Pro with OS X El Capitan, version 10.11.2 as the operating system. The recordings of each participant were saved as .wav files for analysis.

After the data was collected, each elicitation token was isolated using Praat and saved as a separate .wav file. Since four native speakers and four non-native speakers recorded each of the nine elicitation tokens, altogether seventy-two tokens were collected for analysis. The pitch range for the male speakers was set at 75 Hz to 300 Hz, except for male NNS 1 whose range was set at 50 Hz to 300 Hz. The pitch range for the female speakers was set at 100 Hz to 500 Hz, except for female NNS 2 whose range was set at 75 Hz to 500 Hz.

The procedure for the analysis of each token was as follows: first, the demarcation between onset and rhyme was determined based on the analysis of the spectrogram, waveform, formants and pitch as well as auditory analysis. Second, a textgrid was created to identify components of each syllable and to provide a gloss in Chinese and English. Finally, a screen shot was taken of the visual representation of the pitch contour of each elicitation target and saved as a .png image. With regard to the F0 of tones, San Duanmu says “the expected contour does not start until the rhyme starts” (2007: p. 234). Therefore, the rhyme was treated as the tone bearing unit in this study. In addition to the analysis performed on Praat, two native Chinese speakers were recruited to rate the degree of acceptability of the non-native speaker production of Tone 2 based on auditory analysis. Raters classified non-native speaker tone production as sounding native-like, acceptable, or problematic.

3. The canonical features of native speaker production of Tone 2

The pitch contour of Tone 2 featured as a gradual incline rather than a sharp rise in the pitch contours produced by the four native speakers in this study. In our study, Tone 2 reveals a pattern of a slight dipping contour followed by a gradual rise toward the end as Hao's study also demonstrates (2012: p. 272). In addition, most instances of Tone 2, in isolation as well as in combination, show a small hump at the very end of the pitch contour. The highest pitch of Tone 2, therefore, is most often located close to the end of the tone bearing unit on the hump before it drops. Figure 1 demonstrates the canonical features for Tone 2 produced by native speakers in this study.

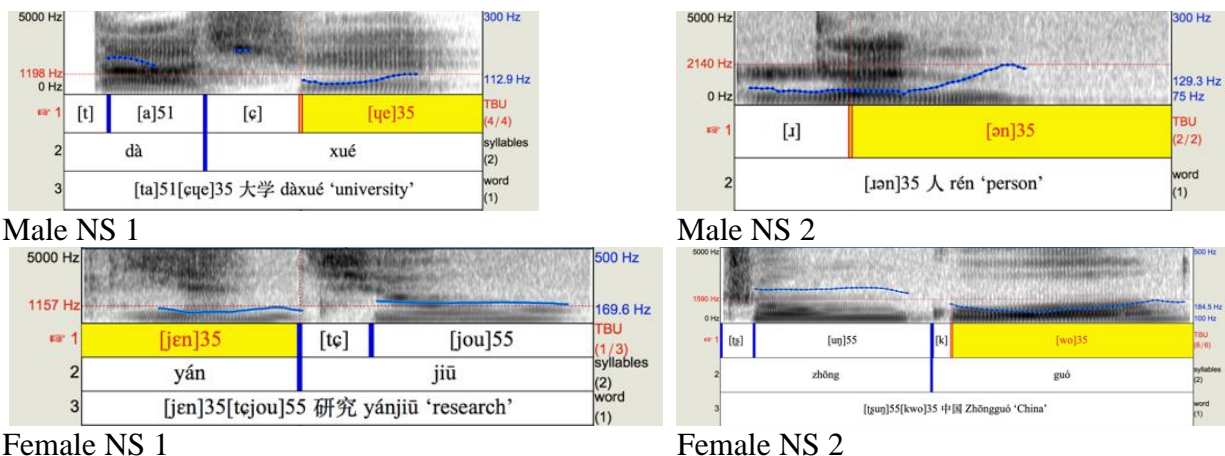


Figure 1: Examples of canonical Tone 2 contours produced by four native speakers

On the basis of this data we predicted that the analysis of non-native speaker production of Tone 2 might show that the most common errors are due to non-native pitch contours.

4. Analysis of non-native speakers' production of Tone 2

This section presents an analysis of the non-native speakers' production of Tone 2 in comparison with that of the native speakers in terms of pitch contour. In this study, non-native speakers' production of the Tone 2 was deemed native-like for 22% of the tokens, acceptable for 17% of the tokens, and problematic for 61% of the tokens. As previously established the analysis of the pitch contour of Tone 2 produced by native speakers shows that Tone 2 in isolation, as well as in almost all combinations, demonstrates a pattern of a slight dipping contour followed by a gradual rise toward the end. Non-native production of Tone 2 was more likely to be rated acceptable or native-like when this dipping contour was present and perceived as problematic when wholly absent. Figure 2 compares native and non-native speaker production of Tone 2 following a voiced initial in [mjəŋ]₃₅[tsɿ]₂ 名字 míngzi 'name.' The native speaker production of T2 demonstrates the canonical pattern and shows that in the case of a voiced initial the dipping contour can begin to be realized on the preceding segment.

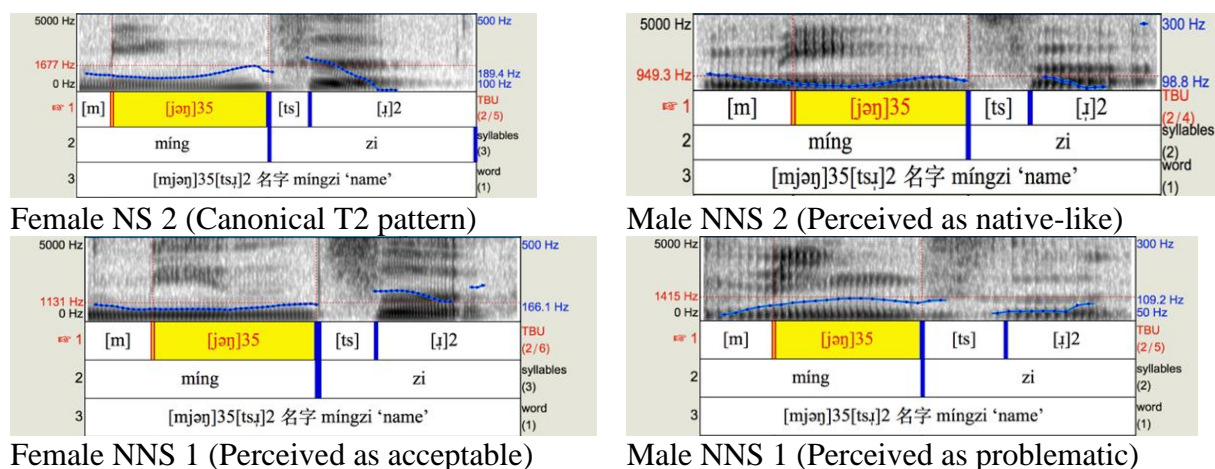


Figure 2: Comparison of NNS and NS production of dipping contour for Tone 2

4.1 Acceptable and native-like production of Tone 2

Production of [mjəŋ]35[tsɿ]2 名字 míngzi 'name' by Male NNS 2 and Female NNS 1 both began to realize a dip on the voiced initial [m] preceding the tone bearing unit and were deemed native-like and acceptable respectively. Comparison between the contours produced by Male NNS 2 and Female NS 2 shows that Male NNS 2 not only produced a slight dipping contour before the rise, but also a small hump at the end of the tone bearing unit. The primary difference between his pattern and the native speaker's is that his starting point is as high as the highest point before the hump while the starting point of the native speaker is slightly lower. The same was true for Female NNS1 whose starting point and ending point were the same height but the hump at the end was less pronounced. This means that the native speaker's Tone 2 shows more overall rise than both Male NNS 2 and Female NNS 1. Although Male NNS 1 produces more rise than the other two non-native speakers shown in Figure 2, his pitch contour lacks any kind of dip and therefore was perceived as problematic. In the analysis below we examine this error and three other types of problematic production of Tone 2.

4.2 Rising contours without a dip

The dipping contour, prevalent among native speakers, was not a feature that the non-native speakers in this study produced consistently. On the contrary, the non-native speakers often produced either a convex contour or had long level phase before the rise as shown in Figure 3 below.

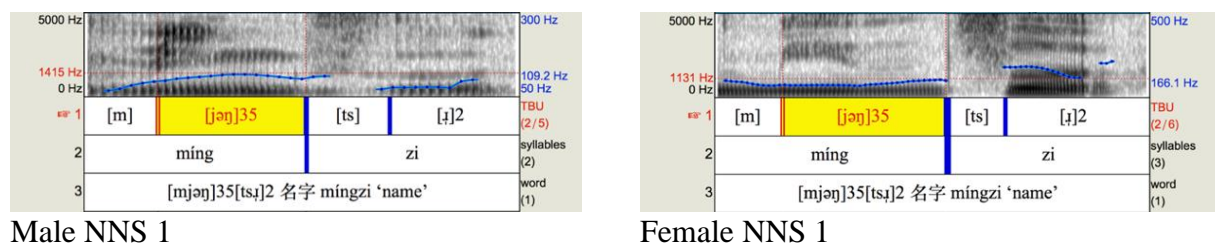


Figure 3: NNS production of convex and level pitch contours for Tone 2

In Figure 3, one can see that Male NNS 1, when producing Tone 2 in T2 + T5 combination, raises his tone gradually across the majority of the tone bearing unit. However, instead of a slight dipping contour, what he produced is more like a convex contour. In this case, his Tone 2 was deemed problematic despite the overall rise in pitch. Female NNS 1, despite the dip on the preceding nasal segment, produced a long level phase before the rise. This contour, was considered acceptable although not native-like.

These examples of non-native speakers' production of Tone 2 show that although Tone 2 is a rising tone, if the rise creates a convex contour, it does not sound like a Tone 2 to a native speaker. On the contrary, if the rise is preceded by a slight dipping contour, even if the rise is comparatively small, the presence of this slight dip accentuates the rise in Tone 2 causing it to sound more acceptable or native-like.

4.3 Flat and falling contours

Some of the learners' errors in the production of Tone 2 can be attributed to a pitch contour that shows no rise or even has a falling contour as opposed to one with a gradual rise. Figure 4 shows flat and falling contours in non-native speakers' production of Tone 2 in T2 + T1 combination compared with native speaker production.

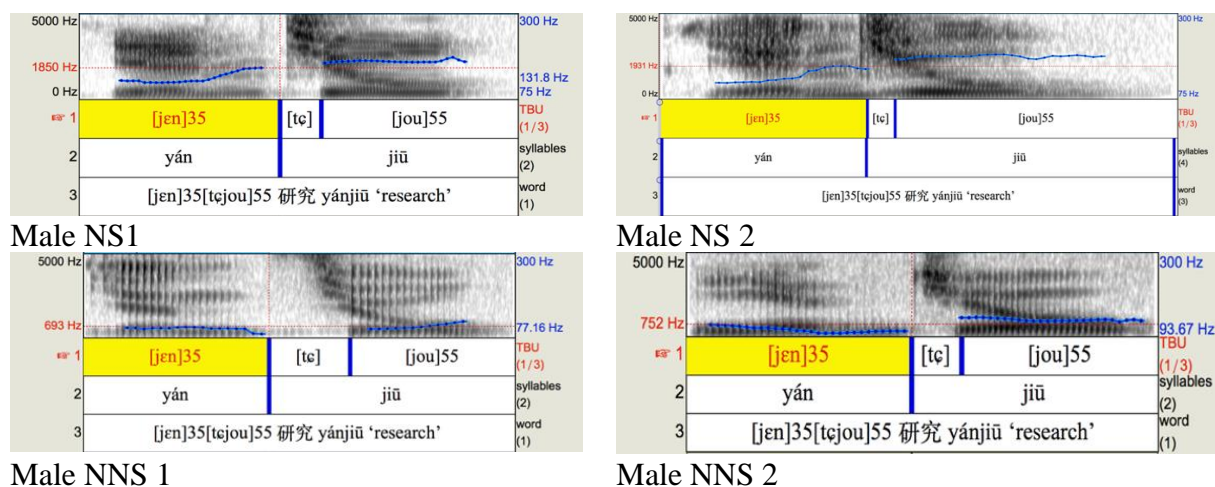


Figure 4: NNS production of flat or falling contours on Tone 2 compared with NS production

Visual analysis of the pitch contours in Figure 4 would not lead one to think that the learners produced a Tone 2. Instead of a gradual rise, Male NNS 1 produced a flat tone with a slight drop in pitch by the end of the tone bearing unit while Male NNS 2 produced a slightly falling tone. Although it seems that there is a slight dip in the middle, the ending point of the tone bearing unit is still lower than the starting point. Both of these productions of Tone 2 were deemed problematic by native-speaking raters.

4.4 Rising contour with a sudden step-up

Another error identified among the non-native speakers in this study is that instead of a gradual and smooth rise in pitch, non-native speakers sometimes produce a sudden step-up in the pitch level to achieve the rising effect as shown in the Figure 5.

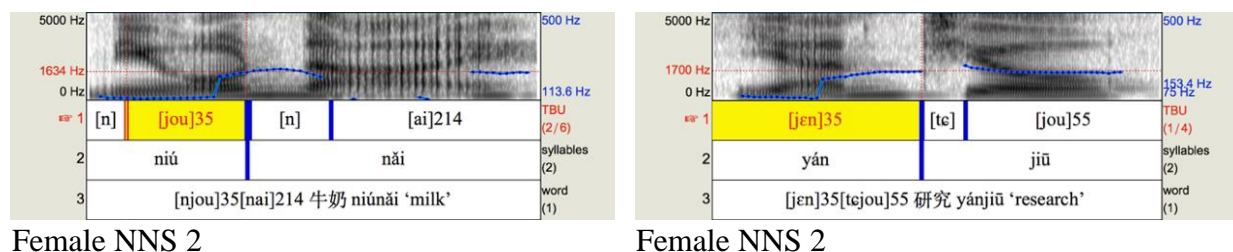


Figure 5: NNS production of a sudden step-up on Tone 2

Such a pattern among non-native speakers seems to indicate that the learner is aware of the fact that Tone 2 is a rising tone. But instead of raising the pitch in a gradual and smooth manner as native speakers do, non-native speakers sometimes produce a sudden step up to reach the ending pitch. Although Tone 2 produced in this manner rises in pitch, it was still deemed problematic in auditory analysis by native speakers.

4.5 Tone 2 being too low

A fourth kind of error identified in this study has to do with starting Tone 2 at a pitch that is too low. It has been widely acknowledged in the literature that Tone 2 is a high rising tone beginning at the mid-point of the pitch register and rising to the high point (Lin 2007:90). However, some of the non-native speakers in this study sometimes produced Tone 2 in the lower half of their register, resulting in an audible creak. As a result, these productions sound like Tone 3 instead of Tone 2. Figure 6 shows the pitch contour for Tone 2 produced with a creak by Male NNS 2 and Female NNS 2. The pitch contour is very low and the white striations in the spectrogram as well as the irregular waveform are evidence of the creakiness of the sound.

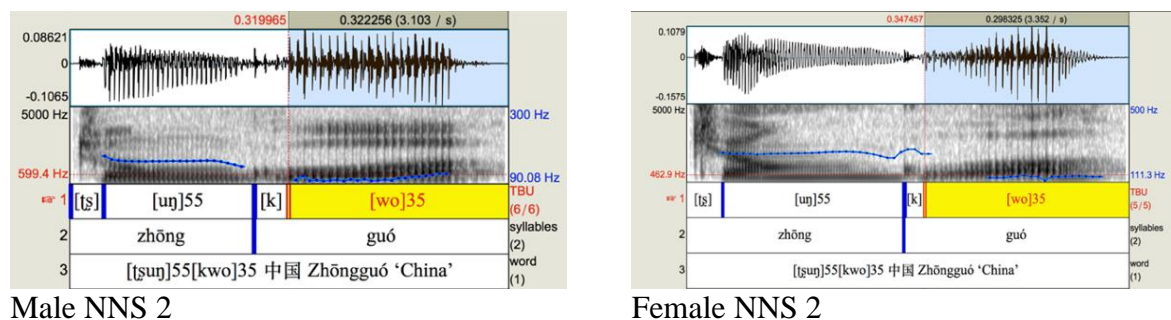


Figure 6: NNS production of a creaky Tone 2

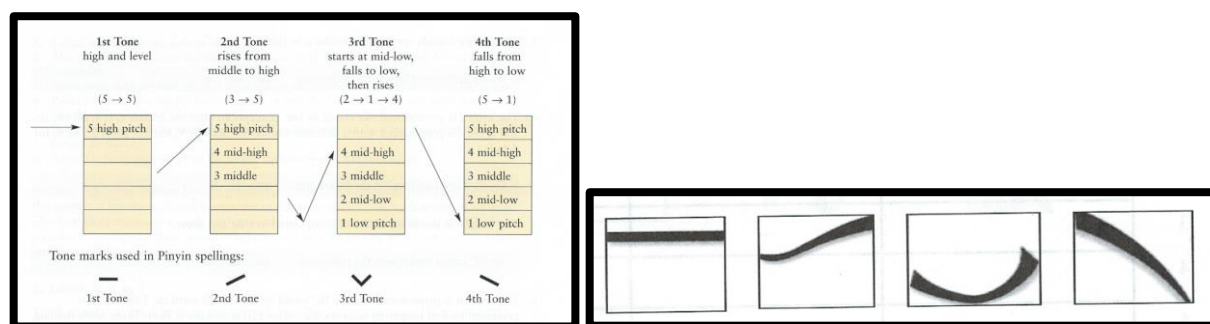
The analysis above has focused on four common Tone 2 production errors observed in this group of non-native speakers. While other errors were also identified in the data, it is beyond the scope of this study to examine each variation in production in detail. We have focused on the four types of errors which seemed to be the most predominant or problematic for this group of non-native speakers, namely rising without a dip, no rise, rising with a sudden step-up and starting too low. Next we will consider how the pedagogical treatment of tone may inadvertently contribute to the persistence of tone errors such as these and suggest interventions which might help set learners on a better path toward visualizing and producing Tone 2.

5. Pedagogical Implications

The findings from this study about the persistent errors of intermediate Chinese language learners have implications for the design of pedagogical materials as well as the kinds of instruction and correction students receive about Tone 2. First of all, students need to be presented with accurate visual representations of Tone 2 that show the slight dip and gradual rise in the pitch contour. In addition, the fact that two of the persistent errors affecting this group of intermediate-level students are producing a Tone 2 that is too flat or too low indicates a need for more careful instruction about the pitch values of Tone 2 relative to other tones.

5.1 Helping students accurately visualize Tone 2

Visual representations of tones in textbooks as well as gestures used by language instructors provide visual models for learners' production of citation tones. Data from this study reveals that all the native speakers produce a slight dip and gradual rise when producing Tone 2. A review of three beginning-level Chinese textbooks was conducted to determine whether this crucial feature is reflected in pedagogical materials. Figure 7 compares the visual representations of Tone 2 in two beginning-level textbooks for Mandarin Chinese learners.



Textbook 1 (Wu et al. 2011:F-3)

Textbook 2 (Walker and Lang 2004:16)

Figure 7: Visual representations of Tone 2 in two beginning-level Chinese textbooks

From Figure 7 above, one can see that the visual representation of Tone 2 in Textbook 2 is the closest to the pattern that we have identified in this study. It presents a gradual rise in pitch and also shows a slight dip at the beginning. In comparison, the diagram found in Textbook 1 provides the student with more precise information about the pitch value of Tone 2 but visually represents the contour as having a steep rise with no dip in the middle. This visualization is further reinforced by the diacritic mark used to indicate Tone 2 in textbooks using *pinyin*. If this is the visual representation that students internalize and try to imitate when producing Tone 2, this could be one reason they produce a Tone 2 contour that lacks the characteristic dip found in the native speakers' production in this study and confirmed in the literature (Hao 2012:272). In a listening discrimination task, Huang (2012: p. 174) found that native speakers "used tonal contour information more effectively" than speakers of American English. This suggests that Chinese language learner might benefit from specific pedagogical interventions that draw their attention to actual features of tonal contours. In the case of Tone 2 this visualization should capture the crucial feature of a slight dip and gradual rise.

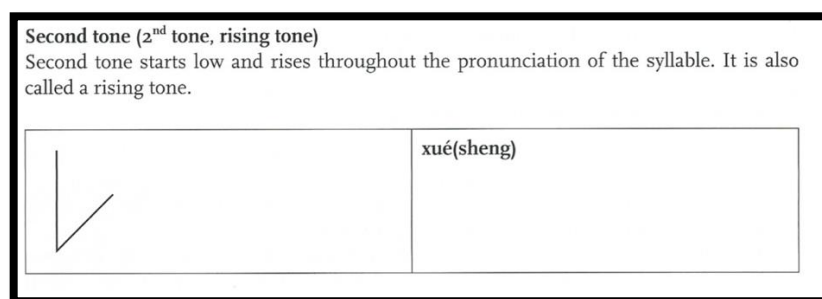
In the classroom, instructors of Mandarin Chinese sometimes use hand gestures to remind students of the patterns of different tones. A commonly used gesture for Tone 2 is a sharp upward motion that resembles the shape of the Tone 2 diacritic mark. Findings from this empirical study

suggest that instructors should adopt a different kind of hand gesture for Tone 2. Instead of a sharp rise, instructors could use a gesture that begins with a slight dip followed by a gradual rise. This kind of gesture can provide students with more accurate visual input regarding the pitch contour and may help them produce a more native-like Tone 2.

5.2 Helping students produce Tone 2 in the correct register

While cognitive reference to an overly stylized visual representation of the Tone 2 contour may partially account for the frequent absence of a slight dip in the pitch contour of non-native speakers, this does not account for why non-native speakers tend to produce a Tone 2 that is too low or too flat. To address this problem, we believe it is important for teachers to provide explicit instruction about Tone 2 being produced in the top half of the pitch register beginning at the mid-point of the register and rising to the high point. In comparing Tone 2 with the other tones, it should be pointed out to students that only Tone 3 is produced in the lower half of the pitch register. The other three tones—Tone 2, Tone 1 and Tone 4 (when followed by another tone)—are all produced in the upper half of the register. Therefore, only Tone 3 should evidence creakiness. If a Tone 2 sounds creaky, this is a sure indication that the student is starting the tone too low. Both Textbook 1 and Textbook 2 provide students with visual information about the pitch level of Tone 2. Textbook 1 provides more detailed linguistic information using pitch numbers while Textbook 2 uses a more simplified presentation that relies on visual comparison of the relative positioning of the four tones in the pitch register.

Unfortunately, students are sometimes presented with misleading information about the pitch of Tone 2 as the following diagram from a beginning-level textbook shows.



Textbook 3 (Ross et al. 2010:11)

Figure 8: Description and visual representation of Tone 2 in a beginning-level Chinese textbook

As shown in Figure 8, Textbook 3 adopts a modified version of Chao's tone letters to provide students with a visualization of the pitch range of the four citation tones. However, both the written description of Tone 2 as starting low and the representation of it as having a pitch from low to mid are at variance with the standard description of Tone 2 pitch beginning in the middle of the pitch range and rising to the top of the range (Lin 2007:93).

6. Conclusion

This study examines the persistent errors of intermediate-level Chinese language learners in the production of Tone 2 by comparing their production with that of native speakers. The pitch contour of Tone 2 produced by native speakers in this study was fairly consistent and featured a gradual incline rather than a sharp rise. The contour of Tone 2 also showed a slight dip before the gradual

rise as Hao's study also demonstrates (2012, p. 272). The highest pitch of Tone 2 was most often located close to the end of the tone bearing unit.

The non-native speaker production of Tone 2 deemed most native-like by native speakers featured a pitch contour with a dip before the final rise just like the native speaker pitch contours. Non-native speaker productions that were deemed less native-like but still acceptable featured a gradual rise without the dip in the middle. In addition, this study identified four pitch contour patterns for Tone 2 produced by non-native speakers that were deemed problematic. These included a convex contour, a flat contour, a falling contour, and a contour that contained a sudden step up to achieve the final rise. The study also documented a pattern of producing Tone 2 at a lower pitch than native speakers, indicating that when correcting tonal errors, Chinese language learners need to be instructed to produce Tone 2 in the upper half of their registers.

The results of this study challenge teachers and textbook writers to re-consider how pitch contours, especially for Tone 2, are visually represented to students and suggests pedagogical interventions for intermediate-level students with persistent Tone 2 errors.

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